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National Occupational Analysis

2012 | Boilermaker

Human Resources and Skills Development Canada
Ressources humaines et Développement des compétences Canada
Canada

National Occupational Analysis

Boilermaker

2012

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FOREWORD

The Canadian Council of Directors of Apprenticeship (CCDA) recognizes this National Occupational Analysis (NOA) as the national standard for the occupation of Boilermaker.

Background

The first National Conference on Apprenticeship in Trades and Industries, held in Ottawa in 1952, recommended that the federal government be requested to cooperate with provincial and territorial apprenticeship committees and officials in preparing analyses of a number of skilled occupations. To this end, Human Resources and Skills Development Canada (HRSDC) sponsors a program, under the guidance of the CCDA, to develop a series of NOAs.

The NOAs have the following objectives:

- to describe and group the tasks performed by skilled workers;
- to identify which tasks are performed in every province and territory;
- to develop instruments for use in the preparation of Interprovincial Red Seal Examinations and curricula for training leading to the certification of skilled workers;
- to facilitate the mobility of apprentices and skilled workers in Canada; and,
- to supply employers, employees, associations, industries, training institutions and governments with analyses of occupations.

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This analysis was prepared by the Labour Market Integration Directorate of HRSDC. The coordinating, facilitating and processing of this analysis were undertaken by employees of the National Occupational Analysis (NOA) development team of the Trades and Apprenticeship Division. The host jurisdiction of British Columbia also participated in the development of this NOA.

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To facilitate understanding of the occupation, the work performed by tradespersons is divided into the following categories:

Blocks	the largest division within the analysis that is comprised of a distinct set of trade activities
Tasks	distinct actions that describe the activities within a block
Sub-Tasks	distinct actions that describe the activities within a task
Key Competencies	activities that a person should be able to do in order to be called 'competent' in the trade

The analysis also provides the following information:

Trends	changes identified that impact or will impact the trade including work practices, technological advances, and new materials and equipment
Related Components	a list of products, items, materials and other elements relevant to the block
Tools and Equipment	categories of tools and equipment used to perform all tasks in the block; these tools and equipment are listed in Appendix A
Context	information to clarify the intent and meaning of tasks
Required Knowledge	the elements of knowledge that an individual must acquire to adequately perform a task

The appendices located at the end of the analysis are described as follows:

Appendix A — Tools and Equipment	a non-exhaustive list of tools and equipment used in this trade
Appendix B — Glossary	definitions or explanations of selected technical terms used in the analysis
Appendix C — Acronyms	a list of acronyms used in the analysis with their full name
Appendix D — Block and Task Weighting	the block and task percentages submitted by each jurisdiction, and the national averages of these percentages; these national averages determine the number of questions for each block and task in the Interprovincial exam
Appendix E — Pie Chart	a graph which depicts the national percentages of exam questions assigned to blocks
Appendix F — Task Profile Chart	a chart which outlines graphically the blocks, tasks and sub-tasks of this analysis

DEVELOPMENT AND VALIDATION OF ANALYSIS

Development of Analysis

A draft analysis is developed by a committee of industry experts in the field led by a team of facilitators from HRSDC. This draft analysis breaks down all the tasks performed in the occupation and describes the knowledge and abilities required for a tradesperson to demonstrate competence in the trade.

Draft Review

The NOA development team then forwards a copy of the analysis and its translation to provincial and territorial authorities for a review of its content and structure. Their recommendations are assessed and incorporated into the analysis.

Validation and Weighting

The analysis is sent to all provinces and territories for validation and weighting. Participating jurisdictions consult with industry to validate and weight the document, examining the blocks, tasks and sub-tasks of the analysis as follows:

BLOCKS	Each jurisdiction assigns a percentage of questions to each block for an examination that would cover the entire trade.
TASKS	Each jurisdiction assigns a percentage of exam questions to each task within a block.
SUB-TASKS	Each jurisdiction indicates, with a YES or a NO, whether or not each sub-task is performed by skilled workers within the occupation in its jurisdiction.

The results of this exercise are submitted to the NOA development team who then analyzes the data and incorporates it into the document. The NOA provides the individual jurisdictional validation results as well as the national averages of all responses. The national averages for block and task weighting guide the Interprovincial Red Seal Examination plan for the trade.

This method for the validation of the NOA also identifies common core sub-tasks across Canada for the occupation. If at least 70% of the responding jurisdictions perform a sub-task, it shall be considered common core. Interprovincial Red Seal Examinations are based on the common core sub-tasks identified through this validation process.

Definitions for Validation and Weighting

YES	sub-task performed by qualified workers in the occupation in a specific jurisdiction
NO	sub-task not performed by qualified workers in the occupation in a specific jurisdiction
NV	analysis Not Validated by a province/territory
ND	trade Not Designated in a province/territory
NOT COMMON CORE (NCC)	sub-task, task or block performed by less than 70% of responding jurisdictions; these will not be tested by the Interprovincial Red Seal Examination for the trade
NATIONAL AVERAGE %	average percentage of questions assigned to each block and task in Interprovincial Red Seal Examination for the trade

Provincial/Territorial Abbreviations

NL	Newfoundland and Labrador
NS	Nova Scotia
PE	Prince Edward Island
NB	New Brunswick
QC	Quebec
ON	Ontario
MB	Manitoba
SK	Saskatchewan
AB	Alberta
BC	British Columbia
NT	Northwest Territories
YT	Yukon Territory
NU	Nunavut

ANALYSIS

Safe working procedures and conditions, accident prevention, and the preservation of health are of primary importance to industry in Canada. These responsibilities are shared and require the joint efforts of government, employers and employees. It is critical that all parties become aware of circumstances that may lead to injury or harm. Safe learning experiences and work environments can be created by controlling the variables and behaviours that may contribute to accidents or injury.

It is generally recognized that safety-conscious attitudes and work practices contribute to a healthy, safe and accident-free work environment.

It is imperative to apply and be familiar with the Occupational Health and Safety (OH&S) Acts and Workplace Hazardous Materials Information System (WHMIS) Regulations. As well, it is essential to determine workplace hazards and take measures to protect oneself, co-workers, the public and the environment.

Safety education is an integral part of training in all jurisdictions. As safety is an inherent part of all trades, it is assumed and therefore it is not included as a qualifier of any activities. However, the technical safety tasks and sub-tasks specific to the trade are included in this analysis.

SCOPE OF THE BOILERMAKER TRADE

"Boilermaker" is this trade's official Red Seal occupational title approved by the CCDA. This analysis covers tasks performed by a boilermaker whose occupational title has been identified by some provinces and territories of Canada under the following names:

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
Boilermaker	✓	✓	✓		✓		✓	✓	✓				
Construction Boilermaker				✓		✓				✓			

Boilermakers construct, install, erect and dismantle, test, maintain and repair boilers, tanks and other vessels such as exchangers, process towers and smokestacks that contain liquids, gases and dry products. These vessels may have unique characteristics. Boilermakers may work from fabrication drawings (prints) to fabricate components from steel or other materials. They often have to attach rigging and work with cranes and other hoisting devices to lift components into place. The systems must be tested for leaks and other defects and deficiencies to ensure they are operating safely and efficiently.

Boilermakers require a good understanding of welding methods and procedures. However, while welding is a component of this trade, jurisdictions may or may not permit certain welding processes without further certification.

Boilermakers are employed in industries such as metal fabricating, construction, shipbuilding, petroleum, and power generation (hydro, nuclear, thermal). They may be employed in construction and maintenance in a variety of industrial workplaces such as pulp mills, water treatment plants, steel mills, cement, fertilizer and potash plants, breweries, ship yards, offshore platforms, mines and generating stations, as well as ethanol, oil and gas plants and refineries.

Boilermakers use both hot and cold working methods to shape steel components and other materials to form boilers, tanks and vessels. They must use various metal forming machines such as rotary shears, punch presses and bending rolls. Tools such as levels, wedges, grinders and cutting torches are used to lay out, fit and smooth edges so the parts fit together. They also use a variety of test equipment and measuring devices. Boilermakers also use tools common to other trades.

Their work is performed indoors or outdoors and may be at extreme heights or underground. The work environment of boilermakers can expose them to hazards and conditions such as vibration, excessive noise, fumes and other toxic environments, confined spaces, and high degrees of heat.

Key attributes for people entering this trade are: good hand-eye coordination, mechanical aptitude and manual dexterity. Boilermakers must have knowledge of mechanical drawings

and have mathematical aptitudes. They also require strength and stamina to work with heavy components and equipment. It is common in this trade to travel for work opportunities; therefore, boilermakers must adapt to frequently changing work environments.

This analysis recognizes similarities and overlaps with the work of metal fabricators, industrial mechanics (millwrights), steamfitters/pipefitters, ironworkers and welders.

With experience, boilermakers may act as mentors and trainers to apprentices in the trade. They may also advance to supervisory positions, quality assurance inspectors and safety personnel.

The application of new tools such as automated welding, cutting and fitting equipment, pneumatic torque guns, hydraulic torque wrenches, bolt tensioning equipment, strand jacks and nut splitters means that some fabrication procedures are becoming more efficient and safer.

New technologies such as phased array and orbital welding means that boilermakers need to know new fitting and preparation techniques.

Pre-lift meetings increase the awareness of hazards and safety requirements of the specific lift and ensure that all personnel are "on the same page", resulting in more coordination between boilermakers and third parties. Engineered lifts are becoming more common.

Due to new crane and transport technology, many larger components and vessels are delivered to the site as complete modules rather than being assembled on site. More of the boilermakers' fabrication is now done in a shop environment.

New components to reduce emissions are increasingly being installed in facilities such as power plants, gas plants and smelters. Boilermakers are responsible for the construction, installation, maintenance and repair of these components.

To meet energy demands, there is an increase in the construction and upgrade of more co-generation and hydro-electric power plants, ethanol plants and nuclear power plants.

There is a greater emphasis and requirement for additional licenses, certificates and training for specific trade qualifications such as welding, rigging, machinery operation and safety. Specialized training for specific tasks such as bolt tensioning/torquing and bundle pulling is also becoming common.

There is an increasing requirement for documentation and precise recording of tasks being performed. Inspection checklists are being used to check details such as torque values and closure forms for vessels.

ESSENTIAL SKILLS SUMMARY

Essential skills are needed for work, learning and life. They provide the foundation for learning all other skills and enable people to evolve with their jobs and adapt to workplace change.

Through extensive research, the Government of Canada and other national and international agencies have identified and validated nine essential skills. These skills are used in nearly every occupation and throughout daily life in different ways.

A series of CCDA-endorsed tools have been developed to support apprentices in their training and to be better prepared for a career in the trades. The tools can be used independently or with the assistance of a tradesperson, trainer, employer, teacher or mentor to:

- understand how essential skills are used in the trades;
- learn about individual essential skills strengths and areas for improvement; and
- improve essential skills and increase success in an apprenticeship program.

The tools are available online or for order at: www.hrsdc.gc.ca/essentialskills

The essential skills profile for the boilermaker trade indicates that the most important essential skills are **document use, numeracy** and **oral communication**. Boilermakers at the NOA workshop also indicated that **problem solving skills** and **working with others** are also important in their trade.

The application of these skills may be described throughout this document within the competency statements which support each subtask of the trade. The following are summaries of the requirements in each of the essential skills, taken from the essential skills profile. A link to the complete essential skills profile can be found at www.red-seal.ca.

Reading
Boilermakers read summaries of toolbox meetings, short notes from co-workers about work activities and directions on product labels. They also read company policies and procedures on emergency evacuations for example, as well as code books, collective agreements and Material Safety Data Sheets (MSDS). Boilermakers also read reference books such as metal trades handbooks, crane and rigging handbooks and training manuals.

Document Use
Boilermakers locate information in various tables, bills of lading, work procedures, MSDS and equipment catalogues. They interpret various drawings such as rigging, fabrication (prints) and shop drawings to identify work to be completed. They may also make scale drawings.

Writing
Boilermakers may write short notes to co-workers and keep personal logbooks to record daily activities noting information such as hours worked, tasks completed, problems encountered,

observations and concerns. They may also write production plans to sequence and schedule tasks. Boilermakers may complete job safety analysis (JSA) reports, health and safety report forms as well as hazard or near-miss report forms.

Numeracy

Boilermakers schedule their daily work activities. They determine the total weight of materials to be hoisted and use formulas to calculate the working load limit (safe work load) of various wire and fibre ropes. They also measure tube wall thicknesses and calculate tube expansion using formulas. They measure angles to cut tubing or pipe to specifications. They use geometry such as bisecting angles and constructing circles using chords to lay out materials for vessels. Boilermakers use data analysis math to ensure code requirements are met by cross referencing measurements on drawings with industry specifications. They also estimate tube/pipe lengths to perform rough cuts, materials needed for a job and the weight of a load to be lifted. They may also estimate how many workers and hours are required to complete a job. Boilermakers work with both the imperial and metric measurement systems, and therefore must be able to convert between the two systems.

Oral Communication

Boilermakers discuss safety issues with colleagues and supervisors during daily toolbox meetings. They interact with supervisors to get direction and discuss technical issues, health and safety concerns, timelines and personnel matters. They may consult with draftspersons, quality control officers and/or engineers to discuss problems with fabrication drawings (prints) such as code violations, technical challenges and design flaws. They may also consult with union representatives.

Boilermakers are often required to use personal protective equipment (PPE) such as ear protection, Self Contained Breathing Apparatus (SCBA), respirators and full face masks which may impede communication. Boilermakers also work in situations where visibility is restricted. Communication is also challenging because boilermakers often work in confined spaces or in towers, out of hearing range. This necessitates the use of hand signals or two-way radios.

Thinking Skills

Boilermakers use problem solving skills to assess assigned tasks. They may suggest a more feasible timeframe when dealing with tight timelines and while coordinating with other trades. They also determine and implement actions to address hazardous job conditions. For example, they may choose appropriate safety equipment, isolate an area, or call other trades to facilitate assigned tasks.

Working with Others

Due to the potentially dangerous nature of their work, working with others is a critical skill. Often a welder is paired with a boilermaker to form a skilled team. Boilermakers may also work in larger team situations and with other tradespeople. They should be able to communicate effectively, complete the tasks assigned to them and integrate their work with that of the other trades. They must be self-disciplined, ensuring that work done independently is accurate and completed within prescribed time limits.

Computer Use

Boilermakers may use digitized programmable equipment such as scientific calculators, digital levels and lasers. They may also use application equipment (robotics) and computer-controlled equipment such as welding overlays and computer numerical controlled (CNC) cutting machines. Boilermakers may use computer-assisted training tools such as on-line programs, simulators, or software packages for health and safety training. They may also use computer-assisted design (CAD) software.

Continuous Learning

Technical upgrading is offered by companies when new products, procedures and equipment are introduced. Boilermakers may take courses on the job or at community colleges, or access on-line programs. However, one of the most practical ways for boilermakers to gain new expertise is to learn on the job from more experienced co-workers or supervisors. It is common for boilermakers to also have welding certification.

Trends

Safety has become more strictly enforced on worksites. There is an increased requirement for safety documentation, equipment and training. More sophisticated PPE and safety equipment is being used by boilermakers. There are increased restrictions on the use of tools that are not engineered.

Water cutting and plasma cutting equipment are becoming more prevalent on work sites. Welding machines have become more portable for ease of use in the field.

Related Components

All components apply.

Tools and Equipment

See Appendix A.

Task 1 Uses and maintains tools and equipment.

Context

Boilermakers must use and maintain tools and equipment in order to perform the duties of the trade.

Required Knowledge

K 1	types of hand tools such as hammers, chisels, punches, wrenches, screwdrivers and scrapers
K 2	types of electric and pneumatic power tools such as grinders, impact guns, pneumatic torque guns, drills and milling machines
K 3	types of hydraulic power tools such as hydraulic jacks and rams, and hydraulic torque wrenches
K 4	certification requirements for powder-actuated tools
K 5	types of measuring tools such as measuring tapes, transits and steel squares
K 6	types of layout tools such as trammel points, prick/centre punches, dividers and levels
K 7	types of shop equipment such as burning tables, radial drill presses, brake presses, shears and rolls

K 8	types of cutting and welding tools and equipment such as hoses, cables, tips and torches
K9	welding processes
K 10	types of work platforms and access equipment such as scaffolding and ladders
K 11	types of aerial work platforms such as scissor lifts, telescoping man lifts and swing stages
K 12	aerial access equipment such as man baskets and bosun's chairs
K 13	federal, provincial/territorial, municipal and site-specific regulations regarding aerial work platforms and access equipment
K 14	operating procedures of aerial work platforms
K 15	training and certification requirements for aerial work platforms and access equipment
K 16	limitations of aerial work platforms and access equipment
K 17	anchor points
K 18	location considerations such as clearances and access
K 19	rescue plan for aerial work platform failure
K 20	basic maintenance requirements for rigging equipment

Sub-task

A-1.01 Maintains tools and equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

A-1.01.01	clean, lubricate, adjust and store tools and equipment according to specifications in order to keep them in good operating condition
A-1.01.02	recognize worn, damaged and defective tools and equipment
A-1.01.03	sharpen chisels, wedges, chipping hammers and prick/centre punches
A-1.01.04	change worn or dull components such as blades and dies
A-1.01.05	top up fluids for hydraulic equipment to manufacturer-specified levels
A-1.01.06	check cables, connectors and ground clamps for defects such as cuts, breaks and burns
A-1.01.07	remove from service and tag worn, damaged and defective tools and equipment

Sub-task

A-1.02 Uses work platforms and access equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

A-1.02.01	determine scaffold and platform requirements according to job scope and safety regulations
A-1.02.02	interpret and follow scaffold tags to assess whether scaffolding is ready and safe for use and to determine fall arrest requirements
A-1.02.03	secure work platforms and access equipment according to safety regulations
A-1.02.04	install safety features such as toe boards, guard rails, guy wires and fall protection equipment
A-1.02.05	recognize, tag and remove from service worn, damaged and defective work platforms and access equipment

Sub-task

A-1.03 Uses aerial work platforms.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

A-1.03.01	select aerial work platforms for job scope
A-1.03.02	inspect aerial work platforms according to checklist to check components such as hoses, tires and fluid levels, and their operation
A-1.03.03	assess ground conditions and identify overhead hazards, and take corrective measures
A-1.03.04	attach safety harnesses to anchor points on aerial work platforms
A-1.03.05	assemble swing stages to engineered specifications
A-1.03.06	install lifelines for bosun's chairs and swing stages to secure anchor point according to engineered specifications

Sub-task

A-1.04 **Maintains rigging equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

A-1.04.01	clean and lubricate rigging equipment to ensure that the parts run freely and to prevent corrosion
A-1.04.02	store rigging equipment in dry locations out of the elements
A-1.04.03	perform inspection of equipment to recognize damaged and defective rigging equipment, and tag and remove from service

Task 2 — Performs safety-related functions.

Context

Boilermakers must be familiar with the care and use of PPE and safety equipment. Making sure that personnel and public safety is protected is the responsibility of all workers. Specialized safety training is important to carry out work functions.

Boilermakers must monitor confined spaces to ensure the safety of workers doing repairs or construction.

Required Knowledge

K 1	types of PPE such as respirators, harnesses, hard hats, safety glasses and steel-toed boots
K 2	types of safety equipment such as fire extinguishers, fall arrest, safety showers and safety tape
K 3	PPE and safety equipment operations
K 4	training requirements for PPE and safety equipment
K 5	workplace safety and health regulations related to the use of PPE and safety equipment
K 6	site locations and requirements for PPE and safety equipment
K 7	WHMIS and the location of MSDS documents
K 8	workers' rights and responsibilities
K 9	procedures for injury documentation and reporting according to Workers' Compensation Board (WCB) and OH&S requirements

K 10	company safety policies and procedures
K 11	housekeeping practices
K 12	work environment hazards such as plant operations, mobile equipment on-site and overhead cranes
K 13	federal, provincial/territorial and municipal health and safety acts and regulations
K 14	site-specific emergency procedures
K 15	on-site safety locations such as first aid stations, safety showers, eye wash stations and muster points
K 16	disposal and recycling procedures
K 17	hazardous materials such as asbestos, silica and ceramic fibres
K 18	radiation
K 19	locations requiring the monitoring of confined spaces such as vessels and trenches
K 20	hazards of confined spaces such as various gases and surrounding conditions
K 21	types and properties of gases such as chlorine, carbon monoxide and hydrogen sulfide
K 22	site-specific requirements for monitoring confined spaces
K 23	confined space monitoring equipment such as air horns, identification vests, gas monitors and rescue plans

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Sub-task

A-2.01 **Uses personal protective equipment (PPE) and safety equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

A-2.01.01	select PPE and safety equipment according to task
A-2.01.02	complete training requirements for the use of PPE and safety equipment
A-2.01.03	perform fit test for respirators (full and half masks) to ensure a proper seal
A-2.01.04	attach fall arrest equipment to anchor points in accordance with OH&S
A-2.01.05	use SCBA and Supplied Air Breathing Apparatus (SABA) according to site-specific and equipment-specific training

Sub-task

A-2.02 **Maintains personal protective equipment (PPE) and safety equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

A-2.02.01	inspect PPE before each use to verify operating condition and that they are free from damage
A-2.02.02	clean respirator equipment using proper cleaning techniques to keep them hygienic and free from contaminants
A-2.02.03	store PPE and safety equipment in dry and clean location
A-2.02.04	recognize and remove from service worn, damaged and defective PPE and safety equipment

Sub-task

A-2.03 **Maintains safe work environment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

A-2.03.01	recognize hazards such as fire hazards, electrical shocks, gas fumes, flying debris and arc flashes
A-2.03.02	identify ventilation requirements, and select and use ventilation equipment such as air movers and fans according to work conditions
A-2.03.03	set up work environment protection such as hoarding, fire blankets and flash screens
A-2.03.04	perform housekeeping tasks to prevent tripping hazards, falling objects and slips
A-2.03.05	interpret safety and environmental regulations
A-2.03.06	complete safety analysis cards to document tasks to be performed, risks involved and mitigation strategy
A-2.03.07	segregate and dispose of waste materials according to site-specific guidelines
A-2.03.08	recognize, prevent and report personal injury hazards
A-2.03.09	participate in site orientation and safety training

A-2.03.10	handle and store hazardous materials according to WHMIS procedures and specialized training
A-2.03.11	install temporary safety protection such as barriers and lockouts according to site-specific requirements
A-2.03.12	act as a spotter for transporting mobile equipment through site
A-2.03.13	perform spark watch during hot work such as welding and burning
A-2.03.14	participate in behavioural based safety programs

Sub-task

A-2.04 Monitors confined spaces.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

A-2.04.01	complete training as required by site and jurisdictional regulations
A-2.04.02	verify site permits prior to personnel entering confined space
A-2.04.03	communicate with emergency personnel
A-2.04.04	recognize and report emergency situations
A-2.04.05	direct evacuation of confined spaces according to rescue plan
A-2.04.06	document personnel entering and exiting confined spaces, and verify that they are wearing PPE as required by the site permit
A-2.04.07	monitor and document atmospheric conditions of confined spaces according to site permit
A-2.04.08	maintain constant contact with personnel in confined spaces using methods such as two-way radios and line-of-sight

Task 3 — Organizes work.

Context

In order to organize their work, boilermakers must be able to use documents and drawings. Using documentation and drawings requires that boilermakers retrieve information and visualize the information in three dimensions. Proper handling and identification of materials is important to ensure that all required material is well-organized and available for the job.

Required Knowledge

K 1	task requirements
K 2	sequence of operations
K 3	materials required
K 4	requirements of other trades
K 5	fabrication drawings (prints)
K 6	types of specifications such as tolerances, grades of material and welding criteria
K 7	symbols such as welding and steel designation
K 8	types, sizes and grades of materials such as tubes, plates, studs, fibreglass, nuts and bolts
K 9	space constraints
K 10	safety requirements for handling, hoisting and storing gas cylinders and hazardous materials
K 11	material type and properties and their handling requirements
K 12	cribbing and blocking methods
K 13	conversion between metric and imperial systems

Sub-task

A-3.01 Organizes project tasks and procedures.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

A-3.01.01	prioritize sequence of activities in operation
A-3.01.02	coordinate tasks with co-workers and other trades

A-3.01.03	set up work areas, materials and equipment such as shipping containers, tools, tool trailers and cranes according to plans and specifications
A-3.01.04	adapt to changing job conditions such as weather, other trades' work and process concerns
A-3.01.05	estimate time requirement to complete each operation
A-3.01.07	complete documentation required for task such as crane permits, gas testing permits and hot work permits
A-3.01.08	inspect and inventory tools and equipment
A-3.01.09	organize and store tools and equipment

Sub-task

A-3.02 Uses drawings and specifications.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

A-3.02.01	locate and interpret information on drawings and specifications such as measurements, weights and tolerances
A-3.02.02	scale drawings
A-3.02.03	interpret drawings such as fabrication, assembly, structural and engineered lift drawings
A-3.02.04	sketch a diagram to clarify technical information
A-3.02.05	convert between metric and imperial measurements

Sub-task

A-3.03 Handles materials and components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

A-3.03.01	use material handling tools and lifting devices such as forklifts, plate clamps and plate racks
A-3.03.02	identify material requirements for job tasks and organize their storage according to job

A-3.03.03	store material in protected location to prevent contamination such as keeping stainless steel separate from mild steel
A-3.03.04	organize materials according to space available and type of material
A-3.03.05	recognize hazards of unloading materials and components such as uneven weight distribution and capacity of hoisting device
A-3.03.06	determine weights of components and materials by calculating and referring to material documentation

---

Sub-task

A-3.04 Demobilizes site.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

A-3.04.01	remove tools, equipment and excess materials and verify inventory
A-3.04.02	restore work area to original state

Task 4 Performs cutting and welding activities.

Context

Boilermakers use various processes to cut material. They perform tack welding to temporarily join components. For the purpose of this analysis, basic welding is non-structural and not pressure welding.

Final welding and more advanced welding procedures may be performed by qualified boilermaker-welders as allowed by jurisdictional regulations.

Required Knowledge

K 1	oxy-fuel and electric cutting equipment such as automated cutting tools, gougers, plasma cutters and oxy-acetylene torches
K 2	cutting equipment components such as flashback arrestors, tips, strikers, hoses and regulators
K 3	cutting gases such as Mapp™ gas, oxygen, acetylene and propane
K 4	mechanical cutting equipment such as oxygen lances, grinders, band saws, shears, reciprocating saws and water jet cutting tools
K 5	types of material to be cut such as metals, fibreglass and composites

K 6	trade-related metallurgical properties such as ferrous and non-ferrous materials, cross contaminations and material hardness
K 7	lens shades for cutting and welding processes
K 8	types of joints to be used such as butt, double bevel, lap, lay-up (fibreglass) and bolted
K 9	automatic beveling machines
K 10	material grades and sizes
K 11	preparation techniques for welding process to be used
K 12	welding codes and symbols
K 13	codes and standards related to components
K 14	fitting methods and procedures
K 15	parent material to be tacked
K 16	jurisdictional certification requirements
K 17	types and sizes of welding consumables
K 18	PPE requirements for welding process
K 19	basic welding processes such as shielded metal arc welding (SMAW), gas metal arc welding (GMAW), gas tungsten arc welding (GTAW) and flux core arc welding (FCAW)
K 20	purging and damming
K 21	weld defects such as lack of fusion, undercut, porosity and overlap
K 22	duties of a spark watch person during cutting/welding activities
K 23	structural and pressure welding

Sub-task

A-4.01 Cuts material.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

A-4.01.01	select cutting tools and equipment according to material type and job situation
A-4.01.02	set up cutting tools, equipment and work area according to specifications
A-4.01.03	identify cutting issues such as incorrect tip type, poor cut quality, incorrect speed and heat, and faulty and dull equipment

A-4.01.04	take corrective measures such as using appropriate tip for material thickness, adjusting speed and replacing faulty equipment
A-4.01.05	perform cut according to job specifications
A-4.01.06	clean up after the cut to remove sharp edges and slag

---

Sub-task

A-4.02 Prepares joints for fitting.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

A-4.02.01	select and use tools and equipment such as grinders, bevellers, oxy-acetylene torches, milling guns and files
A-4.02.02	set up joints following engineering procedures such as using backer plates or rings
A-4.02.03	prepare material using methods such as grinding, shaping, beveling and cleaning
A-4.02.04	purge and dam components to protect integrity of weld
A-4.02.05	clean joint prior to fit-up to protect integrity of weld and prevent weld defects

---

Sub-task

A-4.03 Fits joints.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

A-4.03.01	select and use tools and equipment such as locking pliers, key plates, strongbacks, C-clamps, levels, hammers, dogs and wedges, hydraulic jacks and hickey bars
A-4.03.02	determine alignment tolerances according to welding procedures to be used
A-4.03.03	set gap between fitted joints according to welding procedures to be used

Sub-task

A-4.04 Performs tack welds.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

A-4.04.01	select and use tools and equipment such as ground clamps and chipping hammers
A-4.04.02	select types of consumables to use according to material being welded and procedure being used
A-4.04.03	pre- and post-heat materials if required by welding procedure and type of material being welded
A-4.04.04	place tack welds according to required strength and accessibility
A-4.04.05	interpret welding codes and symbols

Sub-task

A-4.05 Performs basic welding.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	no	yes	ND	ND	ND

Key Competencies

A-4.05.01	select and use types and sizes of welding consumable according to material being welded and procedure being used
A-4.05.02	interpret welding procedures, welding symbols and documentation
A-4.05.03	set up and use related welding equipment such as machines, cables, purge assemblies and ground clamps
A-4.05.04	set amperage according to electrode consumable, joint type and fit-up
A-4.05.05	perform basic weld joints such as lap, butt, fillet and plug according to welding procedure

Trends

There is new equipment being used including strand jacks and air mats.

Because of technology changes, there are more training courses available on focused areas of rigging.

Related Components

All components apply.

Tools and Equipment

Rigging and hoisting equipment, hand tools, power tools, measuring and layout tools, welding and cutting equipment, work platforms and access equipment, aerial work platforms, PPE and safety equipment.

Task 5 Plans lift.

Context

Lifts are planned to ensure that the proper rigging practices and safety factors are taken into account by boilermakers.

Required Knowledge

K 1	rigging formulas, working load limit (safe work load) and D to D ratio
K 2	properties of load to be lifted such as dimensions, shape, weight and centre of gravity
K 3	area surrounding lift
K 4	signaling methods such as verbal, two-way radios and hand signals
K 5	delegation of responsibilities of personnel such as lead hand, operator, signaler and tag line person
K 6	dry run procedures
K 7	rigging equipment such as slings, shackles and spreader bars
K 8	hoisting equipment such as cranes, blocks, Tirfors™, tuggers, chain falls and come-alongs
K 9	types of cranes such as truck-mounted, conventional and rough terrain
K 10	bundle pullers
K 11	rigging equipment needed for specific applications
K 12	types of ropes used in rigging such as wire, natural and synthetic
K 13	rigging and hoisting capacity and radius

K 14	rigging charts
K 15	swing zone and swing clearance

Sub-task

B-5.01 Determines load.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

B-5.01.01	determine type of load to be hoisted such as boiler related and heat exchanger components according to fabrication drawings (prints)
B-5.01.02	check load for unknown weight factors and material integrity such as product residue, build-up of foreign matter or corrosion
B-5.01.03	measure and estimate total weight of load using required formulas
B-5.01.04	verify total weight of load against fabrication drawings (prints) or bill of lading
B-5.01.05	estimate or calculate centre of gravity by visual inspection and weight distribution
B-5.01.06	select and use tools and equipment such as tape measures, calculators, and reference cards and charts

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Sub-task

B-5.02 Performs pre-lift analysis.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

B-5.02.01	determine final location and orientation of object according to fabrication drawings (prints) and match marks on equipment and structure
B-5.02.02	perform a walk-through to determine travel path and rigging requirements considering factors such as obstacles, head room, opening size and hazards
B-5.02.03	identify location for hoisting equipment considering factors such as ground conditions, crane swing radius, obstacles, load charts and hazards
B-5.02.04	confirm how object will be fastened, shimmed or secured in final location based on fabrication drawings (prints)

B-5.02.05	identify equipment required for rigging removal such as man lifts, scissor lifts, man baskets or scaffolding
B-5.02.06	determine communication methods such as hand signals and two-way radios
B-5.02.07	identify personnel needed to perform rigging tasks
B-5.02.08	determine sling angles, tugger angles and anchor points to identify rigging and hoisting equipment

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Sub-task

B-5.03 Selects rigging and hoisting equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

B-5.03.01	identify rigging equipment such as slings, shackles and chain falls and quantity required according to pre-lift analysis or engineered lift drawing
B-5.03.02	identify rigging equipment such as softeners or type of choker that will protect the load, and the rigging and hoisting equipment
B-5.03.03	identify rigging equipment based on the characteristics of the load such as shape, strength, size and type of material to ensure load control
B-5.03.04	identify rigging equipment based on weight of load and working load limit (safe work load) as well as rigging configuration by interpreting rigging tag information such as date, size and capacity
B-5.03.05	identify hoisting equipment such as cranes, tuggers, chain falls and come-alongs based on weight being hoisted, radius and distance to be lifted, and parts of line used

Sub-task

B-5.04 **Secures lift area.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

B-5.04.01	inform non-essential personnel of the lift and ensure they stay clear of the lifting area
B-5.04.02	perform walk-around to clear hoist area of personnel not associated with the lift
B-5.04.03	establish a safety perimeter by installing barricades, barrier tape, tags and signs appropriate to size of lift

Task 6 Rigs load.

Context Rigging is an integral part of the boilermaker trade. Rigging equipment is used so that loads or personnel can be hoisted in a safe and secure manner.

Required Knowledge

K 1	rigging equipment
K 2	rigging equipment that can be fabricated such as lifting lugs, spreader bars and lashing according to engineering specifications
K 3	jurisdictional regulations regarding fabrication of rigging equipment
K 4	requirements and specifications of rigging
K 5	fabrication methods such as splicing, cutting and welding
K 6	limitations to fabricating rigging equipment
K 7	rigging equipment and practices such as using softeners, positioning shackles and setting spreaders
K 8	integrity of component or attachment point considering factors such as rust and corrosion
K 9	hookup points
K 10	function, advantages and limitations of various sling arrangements such as basket, choker and bridle hitch

K 11	types and functions of knots, bends and hitches
K 12	recognition of damaged rigging equipment

Sub-task

B-6.01 **Inspects rigging equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

B-6.01.01	conduct a visual inspection of all rigging equipment before each use for damage such as kinks, broken strands, tears, cuts and cracks, and remove from service
B-6.01.02	conduct an inspection of all in-use rigging equipment to ensure it is properly secured and tightened according to specifications
B-6.01.03	interpret rigging tag information such as date, size and capacity to ensure proper use, installation and restrictions of use
B-6.01.04	identify damaged equipment as out of service by tagging it or rendering it inoperable

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Sub-task

B-6.02 **Fabricates rigging equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

B-6.02.01	lay out for fabrication according to lug charts, fabrication drawings (prints) and engineered specifications
B-6.02.02	build, construct or assemble rigging equipment according to industry standards or engineered specifications
B-6.02.03	arrange for inspection personnel to inspect equipment to identify possible defects

Sub-task

B-6.03 **Attaches rigging equipment to load.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

B-6.03.01	access rigging points using equipment such as scissor lifts, man lifts and ladders
B-6.03.02	use secondary rigging to transfer loads when required
B-6.03.03	identify and use adjustment rigging equipment such as chain falls and come-alongs
B-6.03.04	identify and attach control devices such as tag lines, holdbacks, guy wires and Tirfors™
B-6.03.05	determine and use appropriate knots to ensure control of load based on lift requirements

Task 7 Hoists load.

Context Hoisting a load is lifting the equipment or components into place. It is done following the rigging plan. In many cases, it is a team effort involving operators, signallers and lead hands. It is important that boilermakers participate in hoisting operations for safety and to ensure that equipment, components and personnel are protected during the operation.

Required Knowledge

K 1	hoisting equipment such as cranes, tuggers and chain falls
K 2	load charts
K 3	identification requirements for hoisting equipment
K 4	capacity of hoisting equipment
K 5	anchor points and outriggers
K 6	hoisting equipment components such as blocks, boom sections and counterweights
K 7	reeving sequences
K 8	crane and tugger assembly procedures

K 9	blocks and tackles
K 10	operation of hoisting equipment such as chain falls, tuggers and come-alongs
K 11	certification requirements for the operation of certain hoisting equipment such as fork trucks, carry decks and overhead cranes
K 12	types of hoisting operations such as pulling, pushing and transferring rigging
K 13	methods used to secure load such as using guy wires, using come-alongs, lashing and welding
K 14	potential dangers during rigging (pinch points) and rigging removal
K 15	cribbing

Sub-task

B-7.01 Inspects hoisting equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

B-7.01.01	verify that inspection certification dates are valid
B-7.01.02	identify damaged or worn hoisting equipment that may need to be replaced prior to assembly
B-7.01.03	conduct visual inspection of hoisting equipment to ensure proper installation
B-7.01.04	conduct a walk-around of hoisting equipment to ensure rigging is installed and the hoisting equipment is fully prepared for the lift

---

Sub-task

B-7.02 Assembles hoisting equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

B-7.02.01	connect components of hoisting equipment such as cranes, strand jacks, tuggers, and jack and roll equipment
B-7.02.02	identify the order in which components must be assembled

B-7.02.03	select and use tools and equipment required to assemble hoisting equipment such as cranes, hammers and blockings
B-7.02.04	identify appropriate method and requirements when assembling hoisting equipment such as spooling cable on a drum

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Sub-task

B-7.03 Performs hoisting operations.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

B-7.03.01	participate in a pre-lift meeting to understand role of all participants involved in the hoist
B-7.03.02	use hoisting communication methods such as hand signals and two-way radios
B-7.03.03	coordinate activities between rigging personnel and the equipment operator or operators involved in a tandem hoist
B-7.03.04	operate equipment involved in a hoist such as forklifts, chain falls, come-alongs, tuggers and Tirfors™
B-7.03.05	recognize hazards and correct lift irregularities

Sub-task

B-7.04 Secures load before rigging removal.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

B-7.04.01	use fabrication drawings (prints), match marks and other reference points to confirm proper orientation of a load before detaching from hoisting equipment
B-7.04.02	use shims, wedges, cribbing, guy wires and lines, and other equipment to ensure stability of load
B-7.04.03	use bolts, nuts, welding, bull pins and other similar equipment to prepare the load for removal from rigging

B-7.04.04	use proper grounding when welding is required while load is attached to hoisting device
B-7.04.05	use lashing, rope or other equipment to temporarily suspend loads for subsequent placement

Task 8 — Performs post-lift activities.

Context — These tasks are done after the lift is completed. They may be performed by the same crew responsible for the lift, or an entirely different crew.

Required Knowledge

K 1	inspections done after each lift
K 2	inspections done after job completion
K 3	"as found" state in lift area
K 4	hoisting equipment requiring disassembly
K 5	types of cranes and tuggers requiring disassembly
K 6	crane components such as matting, counterweights, gantries and boom sections
K 7	break-down procedures and sequences
K 8	rigging and hoisting equipment required to do disassembly
K 9	storage procedures and conditions

Sub-task

B-8.01 Conducts post-lift inspection.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

B-8.01.01	inspect area for hazards, obstructions, damages and other anomalies
B-8.01.02	eliminate any hazards identified during the post-lift inspection by taking actions such as installing barriers and signs, and re-installing grating
B-8.01.03	assess, tag and report any damaged equipment
B-8.01.04	advise that area is clear by removing barriers and communicating with others

Sub-task

B-8.02 Disassembles hoisting equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

B-8.02.01	coordinate work with operators if other equipment is required
B-8.02.02	identify steps for taking apart hoisting equipment in the correct order
B-8.02.03	select and use tools and equipment for breaking down hoisting equipment
B-8.02.04	load, tag and secure equipment for transport

Trends

Boilermakers often work on new construction. The fabrication and assembly process has been streamlined due to larger prefabricated components being brought to sites, thus shortening construction timelines. Boilermakers fabricate, assemble and fasten vessels and components on site and in the shop.

Related Components (including, but not limited to)

Blast furnaces, stoves, coke ovens, tanks, stacks, breeching, vessels, ductwork, boilers, precipitators, scrubbers, rectifiers, burners, water heaters, towers, exchangers, crackers, bag houses, fin-fan coolers, water towers, ships, generators, kilns, penstocks, scroll casing, hoppers.

Tools and Equipment

See Appendix A.

Task 9 Performs fabrication.

Context

Fabrication is the creation of the components from stock material following specific instructions from a plan or a concept. Most components are built in a shop and transported to the jobsite; however, fabrication can also occur in the field.

Required Knowledge

K 1	types of materials to be used and components being fabricated
K 2	layout methods such as parallel-line, triangulation and radial-line development and mathematical formulas
K 3	types of tools and equipment and their functions
K 4	forming methods such as braking and rolling
K 5	heating processes such as oxy-acetylene, pre-heat and post-heat methods
K 6	fastening methods such as bolting, welding and expanding
K 7	fabrication specifications

Sub-task

C-9.01 **Lays out components for fabrication.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

C-9.01.01	select and locate material and components according to fabrication drawing (print) specifications
C-9.01.02	measure material to ensure proper dimensions such as thickness, length and projection according to fabrication drawing (print) specifications
C-9.01.03	select and use tools such as measuring tools, straight edges, levels and marking tools
C-9.01.04	perform mathematical calculations to obtain proper orientation, alignment and projections according to job specifications
C-9.01.05	transfer dimensions and measurements to components and materials according to fabrication drawing (print) specifications
C-9.01.06	make jigs and templates according to job and engineering specifications
C-9.01.07	identify and mark various sections of final product for site assembly and installation using methods such as match-marking and tagging

Sub-task

C-9.02 **Cuts components for fabrication.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

C-9.02.01	select cutting method such as oxy-fuel, grinding and gouging, according to material type and thickness, and job site conditions and specifications
C-9.02.02	select tools and equipment determined by cutting method
C-9.02.03	set up cutting tools according to specifications
C-9.02.04	position and secure material to be cut
C-9.02.05	perform cut according to fabrication drawing (print) specifications
C-9.02.06	measure components to ensure accuracy

Sub-task

C-9.03 Forms components for fabrication.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

C-9.03.01	select and use shop equipment such as brakes, rolls and dies to form components
C-9.03.02	select and use hand and power tools to form components
C-9.03.03	shape component using methods such as rolling, bending and braking, according to plans and specifications
C-9.03.04	check components against plans and specifications
C-9.03.05	finish fabricated material by buffing, cleaning and grinding

Sub-task

C-9.04 Constructs components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

C-9.04.01	select and use tools and equipment such as squares, levels, clamps, wrenches and welding machines
C-9.04.02	fit by aligning and orienting components according to match-mark and fabrication drawing (print) specifications
C-9.04.03	secure components to ensure correct alignment and maintain their shape by using methods such as clamping, dogging and bracing
C-9.04.04	join components using methods such as welding and bolting

Task 10 Assembles and fits vessels and components.

Context Pre-assembly is assembling vessels or components in sections or modules prior to final installation. Aligning is putting the components and vessels in the desired location. Fitting ensures the proper placement of the vessels and components prior to fastening them in place.

Required Knowledge

K 1	orientation, elevation and projection methods and procedures
K 2	fitting methods and procedures
K 3	pre-assembly requirements and procedures
K 4	tools and equipment and their functions

Sub-task

C-10.01 Aligns vessels and components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

C-10.01.01	select alignment tools and equipment such as transits, water levels and plumb bobs
C-10.01.02	identify reference point such as benchmark or elevation mark according to fabrication drawings (prints)
C-10.01.03	place vessels and components at desired location according to the fabrication drawing (print) specifications
C-10.01.04	check elevation, orientation and projection of vessels and components to confirm placement

Sub-task

C-10.02 Fits vessels and components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

C-10.02.01	inventory and pre-assemble components according to fabrication drawing (print) specifications
C-10.02.02	check components for fit and function by measuring and dry fitting
C-10.02.03	select and use tools and equipment such as levels, dogs, wedges and hammers according to job requirements
C-10.02.04	measure, match mark and cross reference elevation, orientation and projection of components according to fabrication drawings (prints)
C-10.02.05	attach components using methods such as bolting, clipping and tacking

Task 11 Fastens components.

Context Boilermakers use several techniques to fasten components during construction. This is a critical task in order to complete the final installation.

Required Knowledge

K 1	types, grades and sizes of bolts
K 2	bolting sequence
K 3	bolt tensioning equipment
K 4	expansion theory and techniques
K 5	types and grades of fibreglass materials such as cloth, resins and fillers
K 6	mixing and curing procedures
K 7	accelerators, retarders and promoters
K 8	tools and equipment
K 9	certification requirements
K 10	tolerances

Sub-task

C-11.01 Bolts components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

C-11.01.01	select bolt types, grades and sizes for application
C-11.01.02	prepare components prior to fastening using methods such as lubricating, cleaning and buffing
C-11.01.03	install hardware such as gaskets, bolts, nuts and washers, or studs according to job specifications
C-11.01.04	select and use tools and equipment such as torque wrenches, impact guns, pneumatic torque guns, hydraulic torque wrenches and bolt tensioning and torqueing equipment, and hammer wrenches
C-11.01.05	ensure final fit before tightening bolts on vessels and components
C-11.01.06	torque and tension bolts according to specifications

Sub-task

C-11.02 Expands tubes.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

C-11.02.01	select and use expansion tools and equipment such as rolling guns, mandrels and rolls
C-11.02.02	disassemble, clean, lubricate and reassemble rolling components to prevent damage to equipment
C-11.02.03	prepare surface by grinding, buffing and cleaning
C-11.02.04	roll tubes according to job specifications
C-11.02.05	measure final expansion to confirm job specifications by using measuring instruments such as inside micrometers and various gauges

Sub-task

C-11.03 Lays up fibreglass.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	no	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

C-11.03.01	select and use tools and equipment such as mats, catalysts and promoters
C-11.03.02	prepare surface to be fibreglassed by grinding, sanding and cleaning
C-11.03.03	mix fibreglass resins according to manufacturers' and job specifications, and environmental considerations
C-11.03.04	apply lay-up techniques such as rolling, brushing and spraying
C-11.03.05	identify and repair malformations such as air bubbles, delamination and impurities
C-11.03.06	store and dispose of fibreglass materials

BLOCK D UPGRADING, MAINTENANCE AND REPAIR

Trends

Environmental concerns and more stringent regulations are driving the development of new industry technology. Boilermakers are required to upgrade and install new emissions control systems such as scrubbers, bag houses and carbon storage.

Related Components

All components apply.

Tools and Equipment

See Appendix A.

Task 12 Services vessels and components.

Context

Boilermakers help to ensure the proper operation of vessels and components by verifying their integrity and repairing them as needed. Modifying existing systems entails replacing components and materials to improve performance or reliability, and can be done during scheduled and unscheduled maintenance. Sometimes, vessels and components cannot be repaired and need to be replaced. Boilermakers need to know when rigging, fitting and cranes are needed to accomplish the tasks.

Inspecting and testing are important to identify defective and worn components to ensure that the system has been constructed or repaired properly.

Required Knowledge

K 1	site conditions
K 2	scope of work
K 3	existing system, vessels and components
K 4	permit requirements such as gas tests, hot and cold work and confined space
K 5	required changes as detailed in the fabrication drawings (prints) and specifications

K 6	systems and components to be maintained or repaired
K 7	company and worksite policies and procedures
K 8	safety procedures and requirements such as ensuring proper ventilation, installing bulkheads and performing lock-out procedures
K 9	installation methods and procedures
K 10	vessels and components to be replaced and installed
K 11	gas testing requirements
K 12	types of fasteners and fastening methods such as bolting, welding and expanding
K 13	inspection methods and procedures
K 14	non-destructive test (NDT) methods such as hydrostatic, air testing and vacuum testing
K 15	vessels and components to be tested such as new vessels, exchangers, towers, boilers and tanks

---

Sub-task

D-12.01 Inspects vessels and components for defects.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

D-12.01.01	clean welded surface for inspection by grinding, chipping or buffing
D-12.01.02	perform visual inspection to recognize common defects such as dents, cracks and corrosion
D-12.01.03	perform visual inspection to identify leaks
D-12.01.04	request non-destructive testing such as ultrasound or mag particle inspection to determine material integrity
D-12.01.05	purge tubes to ensure that there are no foreign objects or blockages
D-12.01.06	inspect components such as curtains and electrodes for alignment and defects
D-12.01.07	report deficiencies and defects to the supervisor or quality control inspector

Sub-task

D-12.02 Upgrades vessels and components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

D-12.02.01	verify that permit requirements are met to proceed with upgrade
D-12.02.02	isolate, blind, blank, and lock and tag to prevent exposure and contamination of work area
D-12.02.03	identify site modification requirements such as demolition, component removal and adjustments to be performed by other trades
D-12.02.04	select and use tools and equipment such as impact wrenches, grinders, torches and layout tools
D-12.02.05	create access or openings to work area
D-12.02.06	move materials to appropriate location for installation
D-12.02.07	lay out components to be installed according to fabrication drawings (prints) or job specifications
D-12.02.08	fit components to existing vessels and components
D-12.02.09	fasten components to existing vessels and components using methods such as bolting and welding

Sub-task

D-12.03 Replaces vessels and components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

D-12.03.01	locate vessels and components to be replaced according to fabrication drawings (prints) and job specifications
D-12.03.02	select and use tools and equipment such as grinders, wrenches, torches, gougers and rigging equipment
D-12.03.03	identify site requirements such as demolition, component removal and adjustments to be performed
D-12.03.04	remove vessels and components using methods such as flame cutting, grinding, gouging and unbolting

D-12.03.05	dispose of old vessels and components according to site regulations
D-12.03.06	prepare work area for installation of new vessels and components by using methods such as cleaning, grinding and chipping
D-12.03.07	install new vessels and components according to fabrication drawings (prints) and job specifications

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Sub-task

D-12.04 Prepares vessels and components for maintenance.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

D-12.04.01	access, or create openings to, work area to install ventilation, lighting and power
D-12.04.02	set up work area such as scaffolding, maintenance decks, temporary work platforms and needle beams
D-12.04.03	select and use tools and equipment such as chipping guns, buffers, torches, impact guns and gougers
D-12.04.04	clean, buff and grind parent material and repair pieces

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Sub-task

D-12.05 Repairs vessels and components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

D-12.05.01	select and use tools and equipment such as milling guns, grinders, torches, wrenches and levels
D-12.05.02	lay out vessels and components to be repaired according to fabrication drawings (prints) and job specifications
D-12.05.03	cut or dismantle area and remove components to be repaired by using tools such as torches, reciprocating saws and hammers
D-12.05.04	clean and prepare area to be repaired
D-12.05.05	fit new components by aligning and orientating them according to fabrication drawings (prints) and job specifications

D-12.05.06	fasten new components by using methods such as bolting and welding
D-12.05.07	reinstall any components removed during repair preparation

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Sub-task

D-12.06 Performs preventative maintenance.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

D-12.06.01	select and use tools and equipment such as chipping guns, buffers and grinders
D-12.06.02	scrape, buff and clean components to remove contaminants and corrosion
D-12.06.03	recognize worn, damaged and defective vessels and components such as shields, wear plates and filters
D-12.06.04	inform appropriate authority of possible defects
D-12.06.05	plug tubes to isolate them from system to prevent further damage
D-12.06.06	install shielding and wearing materials to prevent excessive wear on vital components

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Sub-task

D-12.07 Tests materials, vessels and components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

D-12.07.01	select and use tools and equipment such as wrenches, impact guns, gauges, air lines, manifolds and waterlines
D-12.07.02	prepare components for testing by attaching testing equipment and venting
D-12.07.03	inspect tubes to ensure that they are clear prior to testing by using tools such as purge cables, cleaning pigs and borescopes
D-12.07.04	perform hydrostatic tests using equipment such as pressure gauges and pumps

D-12.07.05 perform vacuum box tests and visual inspections of fit-ups and welds

D-12.07.06 perform air tests and leak tests

Task 13 Removes vessels and components.

Context Vessels and components are removed to be repaired or replaced. Removing equipment, vessels and components allows easier access and facilitates maintenance and repairs. Obsolete vessels and components also need to be dismantled, demolished or removed.

Required Knowledge

K 1 dismantling methods and procedures

K 2 demolition methods and procedures

K 3 safe work practices such as tying off tools and planks

K 4 vessels and components that can be re-used

K 5 lifting, hoisting, handling and storage methods and procedures

K 6 disposal of waste material according to jurisdictional requirements

K 7 integrity of component or attachment point considering factors such as steel strength, rust and corrosion

Sub-task

D-13.01 Dismantles vessels and components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

D-13.01.01 plan which vessels and components are to be dismantled according to job requirements, site conditions and sequence

D-13.01.02 select and use tools and equipment such as gougers, torches, wrenches, impact guns, hydraulic nut splitters and mechanical lifting devices

D-13.01.03 number, match-mark or tag components to organize and salvage dismantled pieces

D-13.01.04 prepare components for dismantling using procedures such as installing lifting lugs, pre-cutting and removing any obstructions

D-13.01.05	coordinate work with other trades to ensure safe removal of components such as electrical wires, gas lines or instrumentations
D-13.01.06	unbolt, unfasten or cut components or equipment on vessels according to site conditions
D-13.01.07	place components to be reused in secure area for storage and cleaning

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Sub-task

D-13.02 Removes materials.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	NV	yes	yes	yes	yes	yes	ND	ND	ND

Key Competencies

D-13.02.01	plan material and scrap removal according to job requirements and site conditions
D-13.02.02	select and use tools and equipment such as torches, gougers, hammers, rigging equipment and mobile equipment
D-13.02.03	sort and dispose of material according to jurisdictional requirements

APPENDICES

APPENDIX A — TOOLS AND EQUIPMENT

Personal Protective Equipment and Safety Equipment

atmospheric testing equipment
coveralls (fire retardant, acid-resistant, plastic oversuit)
CSA protective footwear
cutting goggles
dust masks
ear plugs and ear muffs
explosion-proof lights
fall arrest equipment (lanyards, harnesses, retractable lanyards, tripods)
fire extinguishers
grinding shields
ground fault interrupter
hard hat
head lamp
kevlar gauntlets and gloves
leather protective clothing and gloves
personal atmospheric monitoring device
respirator (half mask and full face)
safety glasses, safety goggles and mono goggles
self-contained breathing apparatus (SCBA) and supplied air breathing apparatus (SABA)
side shields
smoke eaters and ventilation systems
tarpaulins
warning tape, tags, signs, barricades
welding lenses
welding screens
welding shields
whip checks and pins

Welding Equipment

anti-spatter spray
chipping hammer
electrode holders (whips/stingers)
electrode ovens (stationary/portable)
electrode pouch
files
fire-retardant blankets
gougers
ground clamps
hand wire brush (mild steel and stainless steel)
inspection mirror
leather welding shield
orbital welders
penlight and batteries
power sources (welding machines) with auxiliary equipment for welding processes such as SMAW, FCAW, GMAW, GTAW and SAW
pre-heating torch and equipment
purge hoses
purge paper
regulators
remote amperage controls
stud welding equipment
temperature ("temp") sticks
welding cable
welding cable "y" connectors
welding electrodes

Cutting Tools and Equipment

Hand Types
bolt cutters
files
hacksaw and blades
handsaw
metal-cutting chisels
metal-cutting snips
pipe/tube cutters
knife
scissors
tap and die sets
utility knife

Powered Types
abrasive cut-off saw
band saw
circular saw
grinders (air and electric)
nibblers
power shears
reciprocating saw
track saw
tube milling machine
water jet cutter

Fuel Cutting Equipment
oxygen lance

Oxy-Fuel Cutting Equipment
adapters
burning and heating tips
flashback arrestors
friction lighters (strikers)
manifold systems
manual cutting torches
oxy-fuel cart
oxy-fuel couplings and wrenches
oxy-fuel cylinders
oxy-fuel hoses and repair kits
radiograph and related equipment
regulators
tip cleaners

Plasma-Arc Cutting Equipment
air line
compressed air source
power supply with cables and torch
regulators
replacement ceramic cups, gouging tips and tips

Air Carbon-Arc Cutting Equipment
air-arc gouger
air and power supply
air line
carbon-cutting electrodes (round/flat)
replacement electrode holder
replacement insulators

Measuring Tools

angle and radius gauges
callipers/dividers
combination square
compass
compound tube gauge
drill point gauge
folding rule
framing squares
measuring tapes
micrometers
scale rule
sliding T-bevel
steel tapes
string line
telescoping gauge
vernier calliper

Marking and Layout Tools

ball peen hammer
chalk
chalk-line
contour marker
dividers
dye
engineer's level
felt pen
laser level
lumber crayon
paint brush
paint marker
piano wire
plumb bob
prick/center punch
protractor
scribe and awl
soapstone and holder
spirit level
squares
steel letter/number set
straight edge
trammel points
transit (theodolite)
water level
wrap-around

Hand Tools

Holding Tools
bar clamp
bench vice
C-clamp
end-cut pliers (nippers)
hammer wrench holder
lineman pliers
locking wrench pliers
needle-nose pliers
pipe vise
side-cutter pliers
sliding clamp (bessey clamp)
slip-joint pliers
water-pump (utility) pliers/channel lock pliers

Holding/Turning Tools
adjustable wrench
back-up (piper) wrench
box-end wrench
chain wrench
combination wrench
hammer (slug) wrench
hex keys
industrial (pulling) wrench
open-end wrench
pipe wrench
ratchet and socket wrench sets
screwdrivers
spud wrench
strap wrench
torque wrench

Fitting Tools

4 lb. hammer
alignment pins
bull pin
clamping angles
claw hammer
dogs and screw dogs
drift pin
flange spreader
hickey bar
hose clamps
hydraulic jack
hydraulic ram
key plates and blank nuts
metal-cutting chisel
non-sparking hammer
pin punch
pry bar
shims and wedges
sledge hammers
soft-face hammer (lead-face)
spud wrench
steel, brass and wood wedges
strongbacks
wall-banger™

Hydraulic and Pneumatic Tools and Equipment

air chippers
air compressor
air grinders
air hammers
air movers
air manifolds/receiver
air supply hose
air utility hoist (air tugger)
drills
bundle puller
filters/oilers
hydraulic nut splitter
hydraulic and pneumatic tensioning equipment
hydraulic rams and jacks
hydrostatic test pump
hydraulic and pneumatic torque wrench
impact wrenches/sockets
milling machine
needle scalers
pneumatic torque guns
regulator
sand blasting equipment
rolling motor

Electric-Powered Tools and Equipment

brake press
CNC tables
cut-off saw
circular saw
die grinder
drills/presses
electric screwdriver
electric supply panel
exhaust fans
extension cords
floodlights
grinders
hammer drill
impact wrench (electric and battery)
induction heat gun
ironworker
jigsaw
nibblers
punch
reciprocating saw
rolls
shears
string/trouble light

Rigging and Hoisting Equipment

air mats
beam clamps
beam trolleys
blocks (tackle, wire rope, snatch)
chain falls
come-along
cranes (truck-mounted, lattice-boom, hydraulic, tower, overhead)
equalizer plates
equalizer sheaves
fibre rope
headache ball
hooks/latches
jacks (hydraulic, screw, air bags)
industrial machine skates
links, swivels, rings, thimbles, eye bolts
load binders and steamboat ratchets
machine rollers
plate clamps
rigging belt
shackles
slings (wire rope, kevlar, fibre material, chain, synthetic web, wire/chain mesh)
softeners
spreader and equalizer beams
strand jacks
swivel hoist ring
telescoping boom forklift
terminal end connections for wire rope (clips, sockets)
Tirfor™ jacks
tuggers
wire rope

Tube Removal/Expansion Tools and Equipment

air motor with adapter sleeves
beading tool
collapsing tools
expansion accessories (e.g., driving links, universals, gear drive)
expanders for boilers and heat exchangers
flaring/belling tools
hydraulic stub puller
induction heat gun
internal tube cutters (revolution tube cutter, fly cutter)
knockout tool
splitting chisels
torque controlled rolling motor
tube end mill
tube plugs
tube pulling spear
tube wall reducing tool

Tube Preparation/Installation Tools

bevel gun
die grinder with variety of stones
files
flapper wheels/emery cloth
hand/power brushes (twist)
brass, lead and plastic hammer
peening tool (hydraulic expander)
serrating tool
tube cut-off saw
tube guide
tube hole reamer
track saw

Tools and Equipment for Fibreglass

aluminum-serrated rollers
barrel heater
brooms
carborundum grinding discs (16-36 grit)
catalyst dispenser
fibreglass material cutting tools
grinder with flexible disc back
heat lamps
kilo scale
masking tape
mohair rollers
paint brushes
plastic buckets
putty knife
resin spray gun/hoses
roll of cardboard
shovels
wooden mixing spatulas

Scaffolding and Access Equipment

aerial work platforms
aluminum framed platform
aluminum planks
boom lifts
bosun chair
electrical articulated boom lift
electrical scissor lifts
electrical vertical lifts
end frames
extension ladder
floats (angel's wings)
gas powered articulated boom lift
gas powered scissor lifts
ladder jack scaffolds
ladders
mechanical scaffolds
ramps
rolling scaffolds
sawhorses
scissor-lift
stationary scaffolds
stepladders
swing stages
temporary access/freight elevator
tube and clamps

APPENDIX B GLOSSARY

bag house	enclosure through which dust particles are collected as exhaust gases pass through a fabric filter
blast furnace	a smelting furnace into which compressed hot air is driven to complete the first stage in the production of all iron-based metals
boiler	a closed vessel in which water is heated, steam is generated, steam is superheated, or any combination thereof, under pressure or vacuum by the application of heat from combustible fuels, electricity or nuclear energy
boom	the main component of a crane used to carry the hoisting tackle
breeching (gas flue)	a transition component from the convection box to the flue
catalyst	an additive that accelerates a chemical reaction
chain fall	a hand/pneumatic/ electric-operated chain hoist
coke oven	tightly sealed unit to keep out air so coal cannot burn; rather it "bakes" with an intense heat up to 2100°F to produce coke
come-along	ratchet-type tool with a chain and hook used for pulling
confined space	an enclosed or partially enclosed and possibly hazardous working area that is not intended for continuous human occupancy that has limited access and egress and where the atmosphere may change during activities
dog	a tool used with a wedge or screw to fit up components
ductwork	a passage for air and gas flow
ferrous	metals dominated by iron in their chemical composition (i.e., carbon and low alloy steels)
fibreglass	glass reinforcement material (i.e., chopped strand mat, woven roving)
hydrostatic test	a strength and tightness test of a closed pressure vessel by water pressure

lashing	a wire rope fastened to itself to temporarily hold a component in position or to safety it until it is fastened
metallurgy	involves the science of producing metals from ores, of making and compounding alloys, and the reaction of metals to many different activities and situations
non-ferrous	metals that contain little or no iron in their chemical composition (e.g., aluminum, copper)
outriggers	extendable beams attached to a crane base mounting that rest on supports at the outer ends and provide a means of stabilizing the crane
oxy-fuel cutting	a group of cutting processes used to sever metals by means of the chemical reaction of oxygen with the base metal at elevated temperatures
parts of line	the number of individual ropes supporting a travelling block in a tackle system
penstock	conveys water from the reservoir to the generating unit such as in a hydro-electric dam
plasma-arc cutting	an arc cutting process that severs metal by melting a localized area with a constricted arc and removing the molten material with a high velocity jet of hot, ionized gas issuing from the orifice
precipitator	an electrostatic filter that separates particulate matter from exhaust gasses
promoter	an additive used with rapid-cure resins to reduce excessive exothermic heat build-up
purge	involves using one gas to displace another gas in an enclosed space or system
resin	a polyester (vinylester) solid usually dissolved in styrene, but when mixed with a catalyst, forms a rigid thermoset plastic
scrubber	an apparatus used to remove solids from gases by entrainment in water
shackle	an anchor-shaped or u-shaped component with a pin that is used in rigging
sling	a wire rope or other material with eyes spliced on each end

spreader bar	beam used for hoisting trusses or long loads; also used to equalize the weight and to keep the load, such as tank plate, from buckling
stack	a vertical conduit used to discharge combustion products to the atmosphere
stove	used to heat air to speed combustion
swing stage	a suspended scaffold
tackle	an assembly of ropes and sheaves arranged for lifting, lowering and pulling
tag line	a length of rope used to control a load during lifting or lowering
Tirfor™	manual or pneumatic pulling machine
tower crane	a power-operated fixed or slewing tower that provides elevation and support for its jib
tube expanding	the pressure-tight joint formed by enlarging a tube end in a tube seat
tugger	a pneumatic or electric winch used for hoisting in tight areas where a crane is impractical
vacuum box test	a non-destructive test designed to find leaks in welded lap joints of a storage tank floor; soapy water is applied to the joint, then the air is removed from the sealed see-through box creating a vacuum and exposing the leaks
vessel	a container designed to contain liquids, gases, or solids
water cutting	a process of using a jet of water under high pressure to sever through a variety of construction materials
water level	flexible clear tubing partially filled with water or glycol used to determine the elevation of an object in relation to a known elevation

APPENDIX C

ACRONYMS

CAD	Computer-assisted design
CNC	Computer Numerical Controlled
CSA	Canadian Standards Association
FCAW	Flux cored arc welding
GMAW	Gas metal arc welding
GTAW	Gas tungsten arc welding
MSDS	Material Safety Data Sheets
NDT	Non-destructive test
OH&S	Occupational Health and Safety
PPE	Personal Protective Equipment
SAW	Submerged arc welding
SABA	Supplied Air Breathing Apparatus
SCBA	Self Contained Breathing Apparatus
SMAW	Shielded metal arc welding
WHMIS	Workplace Hazardous Materials Information System

APPENDIX D — BLOCK AND TASK WEIGHTING

BLOCK A COMMON OCCUPATIONAL SKILLS

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	30	10	NV	20	NV	30	30	24	25	35	ND	ND	ND	26%

Task 1 Uses and maintains tools and equipment.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	40	20	NV	20	NV	25	25	18	30	25	ND	ND	ND	25%

Task 2 Performs safety-related functions.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	20	29	NV	30	NV	30	25	10	30	25	ND	ND	ND	24%

Task 3 Organizes work.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	20	30	NV	20	NV	20	25	32	20	35	ND	ND	ND	25%

Task 4 Performs cutting and welding activities.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	20	30	NV	30	NV	25	25	40	20	15	ND	ND	ND	26%

BLOCK B RIGGING AND HOISTING

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	25	35	NV	25	NV	23	25	32	28	35	ND	ND	ND	28%

Task 5 Plans lift.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	30	20	NV	20	NV	30	30	34	35	45	ND	ND	ND	31%

Task 6 Rigs load.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	35	30	NV	30	NV	30	25	25	30	30	ND	ND	ND	29%

Task 7 Hoists load.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	20	30	NV	30	NV	30	25	27	25	20	ND	ND	ND	26%

Task 8 Performs post-lift activities.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	15	20	NV	20	NV	10	20	14	10	5	ND	ND	ND	14%

BLOCK C NEW CONSTRUCTION

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	20	20	NV	25	NV	22	20	20	27	15	ND	ND	ND	21%

Task 9 Performs fabrication.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	40	40	NV	20	NV	33	40	37	35	55	ND	ND	ND	38%

Task 10 Assembles and fits vessels and components.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	35	30	NV	40	NV	33	40	38	45	30	ND	ND	ND	36%

Task 11 Fastens components.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	25	30	NV	40	NV	34	20	25	20	15	ND	ND	ND	26%

BLOCK D UPGRADING, MAINTENANCE AND REPAIR

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	25	35	NV	30	NV	25	25	24	20	15	ND	ND	ND	25%

Task 12 Services vessels and components.

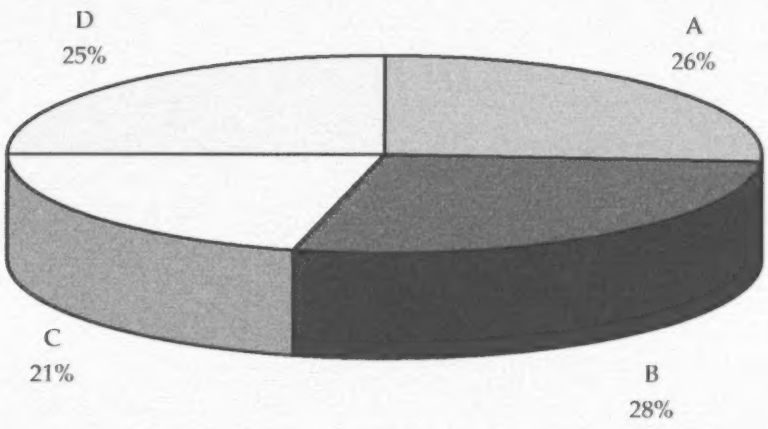
	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	60	75	NV	60	NV	65	60	59	70	90	ND	ND	ND	67%

Task 13 Removes vessels and components.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	40	25	NV	40	NV	35	40	41	30	10	ND	ND	ND	33%

APPENDIX E

PIE CHART*



TITLES OF BLOCKS

BLOCK A	Common Occupational Skills		BLOCK C	New Construction
BLOCK B	Rigging and Hoisting		BLOCK D	Upgrading, Maintenance and Repair

*Average percentage of the total number of questions on an interprovincial examination, assigned to assess each block of the analysis, as derived from the collective input from workers within the occupation from all areas of Canada. Interprovincial examinations typically have from 100 to 150 multiple-choice questions.

APPENDIX F

TASK PROFILE CHART – Boilermaker

BLOCKS	TASKS	SUB-TASKS				
A – COMMON OCCUPATIONAL SKILLS	1. Uses and maintains tools and equipment.	1.01 Maintain tools and equipment.	1.02 Uses work platforms and access equipment.	1.03 Uses aerial work platforms.	1.04 Maintains rigging equipment.	
	2. Performs safety-related functions.	2.01 Uses personal protective equipment (PPE) and safety equipment.	2.02 Maintains personal protective equipment (PPE) and safety equipment.	2.03 Maintains safe work environment.	2.04 Monitors confined spaces.	
	3. Organizes work.	3.01 Organizes project tasks and procedures.	3.02 Uses drawings and specifications.	3.03 Handles materials and components.	3.04 Demobilizes site.	
	4. Performs cutting and welding activities.	4.01 Cuts material.	4.02 Prepares joints for fitting.	4.03 Fits joints.	4.04 Performs tack welds.	4.05 Performs basic welding.
B – RIGGING AND HOISTING	5. Plans lift.	5.01 Determines load.	5.02 Performs pre-lift analysis.	5.03 Selects rigging and hoisting equipment.	5.04 Secures lift area.	
	6. Rigs load.	6.01 Inspects rigging equipment.	6.02 Fabricates rigging equipment.	6.03 Attaches rigging equipment to load.		
	7. Hoists load.	7.01 Inspects hoisting equipment.	7.02 Assembles hoisting equipment.	7.03 Performs hoisting operations.	7.04 Secures load before rigging removal.	

	8. Performs post-lift activities.	8.01 Conducts post-lift inspection.	8.02 Disassembles hoisting equipment.			
C – NEW CONSTRUCTION	9. Performs fabrication.	9.01 Lays out components for fabrication.	9.02 Cuts components for fabrication.	9.03 Forms components for fabrication.	9.04 Constructs components.	
	10. Assembles and fits vessels and components.	10.01 Aligns vessels and components.	10.02 Fits vessels and components.			
	11. Fastens components.	11.01 Bolts components.	11.02 Expands tubes.	11.03 Lays up fibreglass.		
D – UPGRADING, MAINTENANCE AND REPAIR	12. Services vessels and components.	12.01 Inspects vessels and components for defects.	12.02 Upgrades vessels and components.	12.03 Replaces vessels and components.	12.04 Prepares vessels and components for maintenance.	12.05 Repairs vessels and components.
		12.06 Performs preventative maintenance.	12.07 Tests materials, vessels and components.			
	13. Removes vessels and components.	13.01 Dismantles vessels and components.	13.02 Removes material.			